Indian Institute of Technology Jodhpur

Probability, Statistics and Random Processes- MA221

Semester II (2016 - 2017)

Assignment X

1. A bank manager claims that 25 % of the total accounts belong to poor people. A social group disputes this claim, and argues that banks discriminates against poor. A random sample of 120 citizens has 18 poor. Test the manager's claim at the 0.05 level of significance.

2. Two different companies have applied to provide cable television service in a certain region. Let p denote the proportion of all potential subscribers who favor the first company over the second. Consider testing $H_0 : p = 0.5$ versus $H_1 : p \neq 0.5$ based on a random sample of 25 individuals. Let X denote the number in sample who favor the first company and x represents the observed value of X.

   a Which of the following rejection region is most appropriate and why? $C_1 = \{x : x \leq 7 \text{ or } x \geq 18\}$, $C_2 = \{x : x \leq 8\}$, $C_3 = \{x : x \geq 17\}$.

   b What is the probability distribution of X when H_0 is true? Use it to compute the probability of type I error.

   c Compute the probability of type II error for the selected region when $p = 0.3$ and when $p = 0.4$.

3. Let p equal the proportions of drivers who use a seat belt in an area that does not have a mandatory seat belt law. It was claimed that $p = 0.14$. An advertising campaign was conducted to increase this proportion. Two months after the campaign, $y = 104$ out of a random sample of $n = 590$ drivers who were wearing seat belts. Was the campaign successful?

   (i) Define the null and alternate hypotheses.

   (ii) Define a critical region with an $\alpha = 0.01$ significance level.

   (iii) What is your conclusion?

4. Let X be a Geometric random variable with parameter θ. We observe X to decide between $H_0 : \theta = 0.5$ and $H_1 : \theta = 0.1$. Design a 0.05 level test to decide between H_0 and H_1. Also, find the probability of type II error.

5. The following data were obtained to compare persons with disabilities with persons without disabilities. We wish to know at the 99% level, that persons with disabilities score higher than persons without disabilities.
   Disabled: $\bar{x_1} = 31.83, n = 132, s_1 = 7.93$
   Non-Disabled: $\bar{x_2} = 25.07, n = 137, s_2 = 4.80$

6. Following data is from a weight-loss program (kg)
   B (Before): 117.3 111.4 98.6 104.3 105.4 100.4 81.7 89.5 78.2
   A (After): 83.3 85.9 75.8 82.9 82.3 77.7 62.7 69.0 63.9
   We wish to know if the treatment is effective in causing weight reduction in these people at 99% level.

7. Time magzine reported the results of a telephone poll of 800 adult Americans. The question posed of the Americans who were surveyed was: "Should the federal tax on cigarettes be raised to pay for health care reform?" The results of the survey were:
   Non Smokers - $n = 605, X = 351$(said Yes)
   Smokers - $m = 195, Y = 41$(said Yes)
   Is there sufficient evidence at 0.05 level to conlude that the two populations differ significantly with respect to their opinions?

8. A psychologist conducted a survey of a random $n = 34$ male college students and a random $m = 29$ female college students. The results of the survey are -
   Male - $n = 34, \bar{x} = 105.5, s_x = 20.1$
   Female - $m = 29, \bar{y} = 90.9, s_y = 12.2$
   Is there sufficient evidence at 0.05 level to conlude that the varaince of these two populations differ significantly?